1   **PRODUCT SELECTION EXPERT SYSTEM**

2   <u>COPYRIGHT NOTICE AND AUTHORIZATION</u>

11   I.   <u>FIELD OF THE INVENTION</u>

12   The invention relates to computer-implemented process and system for a

13   expert system for product selection.

14   II.   <u>BACKGROUND OF THE INVENTION</u>

15   In the past, customer selection among commercial products with an expert

16   system has been a very difficult procedure requiring a lot of time and user

17   expertise. For example, most product manufactures simply provide many

18   tables of different products. The customer must hunt among these tables to

19   find a product(s) that will suit his needs. Detailed information about the product

20   to allow the customer to make his choice is not readily available. Also, the

21   many factors that go into such a selection make the decision so complex that

22   expert help is often required.

23   Similarly, inputting of expert knowledge into the knowledge database of an

24   expert system has required assistance and intereviewing by the computer

25   engineer building the expert system and the expert.

1 It would be desirable to have an expert system which is user friendly both for
2 the expert and the customer. The instant invention provides such a solution.

3 ## IV.   SUMMARY OF THE INVENTION

4 The proposed invention in one embodiment is a web-based expert system for
5 product selection and method of using the system that allows the experts to
6 quickly input expert knowledge and for a customer to make correct product
7 choices quickly and efficiently. Key aspects of the invention, in one preferred
8 embodiment, include: (1) a graphical user interface that guides the customer
9 through a choice of applications, specifications, and product ratings, and
10 interactively displays a scored list of available products; (2) the entire selection
11 process in shown in segments of just one screen so the user can go back and
12 change his request interactively; (3) a user interface that provides direct links to
13 Web-based product data such as product data sheets and Material Safety Data
14 Sheets, or alternatively provides links to generic web search engines such as
15 Yahoo® or Google®; and (4) has program instructions separate from product
16 information, so that product data can be easily kept up-to-date and distributed
17 through the web. Program instructions are made so easily that it does not
18 require expert computer knowledge. The expert program section can make
19 data changes. The user program can run without the expert program to assure
20 product integrity and avoid tampering with the data by the user

21 More particularly, the invention includes a system for product selection, the
22 system including: a CPU; a memory operatively connected to the CPU, the
23 memory containing a program adapted to be executed by the CPU and the
24 CPU and memory cooperatively adapted for presenting a user interface and
25 expert interface to an expert system for product selection; a expert-interface
26 code segment embodied on a computer-readable medium configured and
27 adapted for: creating and modifying via a graphical user interface a
28 graphically-displayed tree structure representing a plurality of product
29 applications; associating and modifying via a graphical user interface one or
30 more use condition with each node of the tree structure; and associating and
31 modifying via a graphical user interface one or more suitability ratings for a

1   plurality of applications; creating and modifying via a graphical user interface
2   a list of products associating and modifying via a graphical user interface one
3   or more product with each leaf node of the tree structure; associating via a
4   graphical user interface use condition choices with each product associating
5   via a graphical user interface suitability ratings for each product a user-
6   interface code segment embodied on a computer-readable medium
7   configured and adapted for selecting via a graphical-use interface a path in
8   the tree structure, and for displaying on the same window of the graphical-use
9   interface: the products associated with the leaf node of the selected path; the
10   use conditions associated with each node of the selected path; and the
11   product usability suitability indicators associated with each node of the
12   selected path; selecting via the same window of the graphical-use interface
13   one or more of the use conditions associated with the nodes of the selected
14   path and for entering the user-defined relative importance of the product
15   usability suitability indicators for the intended application of the products
16   associated with the leaf nodes of the selected path; comparing the selected
17   use conditions with the displayed products, where products not having such
18   selected use conditions as attributes are filtered out of the displayed list of
19   products; comparing the entered relative importance of the product usability
20   suitability indicators with the product usability suitability indicators associated
21   with the displayed products, associating a score with each displayed product
22   indicating the correlation of the comparison, and displaying the score with the
23   product; and printing the resulting product list, corresponding suitability
24   scores, selected tree path, selected use conditions, and entered relative
25   importance of product usability suitability indicators.

26   Another embodiment of the invention includes a method for product selection
27   comprising: selecting via a graphical-use interface a path in a tree structure,
28   and for displaying on the same window of the graphical-use interface: the
29   products associated with the leaf node of the selected path; the use
30   conditions associated with each node of the selected path; and the product
31   usability suitability indicators associated with each node of the selected path;
32   selecting via the same window of the graphical-use interface one or more of

1   the use conditions associated with the nodes of the selected path and for

2   entering the user-defined relative importance of the product usability suitability

3   indicators for the intended application of the products associated with the leaf

4   nodes of the selected path; comparing the selected use conditions with the

5   displayed products, wherein products not having such selected use conditions

6   as attributes are filtered out of the displayed list of products; comparing the

7   entered relative importance of the product usability suitability indicators with

8   the product usability suitability indicators associated with the displayed

9   products, associating a score with each displayed product indicating the

10 correlation of the comparison, and displaying the score with the product; and

11 printing the resulting product list, corresponding suitability scores, selected

12 tree path, selected use conditions, and entered relative importance of product

13 usability suitability indicators.

14 Another embodiment of the invention includes a machine-readable program

15 storage medium tangibly embodying sequences of instructions, the

16 sequences of instructions for execution by at least one processing system, the

17 sequences of instructions to perform steps for: selecting via a graphical-use

18 interface a path in a tree structure, and for displaying on the same window of

19 the graphical-use interface: the products associated with the leaf node of the

20 selected path; the use conditions associated with each node of the selected

21 path; and the product usability suitability indicators associated with each node

22 of the selected path; selecting via the same window of the graphical-use

23 interface one or more of the use conditions associated with the nodes of the

24 selected path and for entering the user-defined relative importance of the

25 product usability suitability indicators for the intended application of the

26 products associated with the leaf nodes of the selected path; comparing the

27 selected use conditions with the displayed products, wherein products not

28 having such selected use conditions as attributes are filtered out of the

29 displayed list of products; comparing the entered relative importance of the

30 product usability suitability indicators with the product usability suitability

31 indicators associated with the displayed products, associating a score with

32 each displayed product indicating the correlation of the comparison, and

-4-

1 displaying the score with the product; and printing the resulting product list,

2 corresponding suitability scores, selected tree path, selected use conditions,

3 and entered relative importance of product usability suitability indicators.

4 These and other features and advantages of the present invention will be

5 made more apparent through a consideration of the following detailed

6 description of a preferred embodiment of the invention. In the course of this

7 description, frequent reference will be made to the attached drawings.

8   V.   <u>BRIEF DESCRIPTION OF THE DRAWINGS</u>

9 Fig. 1 depicts in one embodiment a schematic diagram of an exemplary

10 expert system.

11 Fig. 2 depicts in one embodiment a schematic system diagram of the

12 invention.

13 Fig. 3 depicts in one embodiment a schematic system diagram of the tree

14 aspect of the invention.

15 Fig. 4 depicts in one embodiment an exemplary XML file implementation of

16 the tree, i.e., the application tree structure, aspect of the invention,

17 Fig. 5 depicts in one embodiment an exemplary XML file implementation of

18 the product data and its association with the application tree data

19 Fig. 6 depicts in one embodiment depicts in one embodiment a schematic

20 process flow diagram for the expert-interface aspect of the invention.

21 Fig. 7 depicts in one embodiment depicts in one embodiment a schematic

22 process flow diagram for the user-interface aspect of the invention.

23 Fig. 8-11 depict in one embodiment exemplary screen shots of the expert-

24 interface aspect of the invention.

1   Fig. 12-21 depict in one embodiment exemplary screen shots of the user-
2   interface aspect of the invention.

3   VI.   DETAILED DESCRIPTION OF THE DRAWINGS AND
4   PREFERRED EMBODIMENTS

5   A.   Introduction
6
7   The following discussion and figures include a general description of a
8   suitable computing environment in which the invention may be implemented.
9   While the invention will be described in the general context of a system and
10   an application program that runs on an operating system in conjunction with
11   general purpose computers, an internet, and web, application, and email
12   servers and clients, those skilled in the art will recognize that the invention
13   also may be implemented in combination with other program modules.
14   Generally, program modules include routines, programs, components, data
15   structures, etc. that performs particular tasks or implement particular abstract
16   data types.
17
18   Moreover, those skilled in the art will appreciate that the invention may be
19   practiced with other computer system configurations, including hand-held
20   devices, multiprocessor systems, microprocessor-based or programmable
21   consumer electronics, minicomputers/servers, workstations, mainframe
22   computers, and the like.
23
24   The invention may also be practiced in distributed computing environments
25   where tasks are performed by remote processing devices that are linked
26   through a communications network. In a distributed computing environment,
27   program modules may be located in both local and remote memory storage
28   devices.
29
30   Then invention generally relates to an expert system for product selection.
31   The process aspects of the invention are a series of process steps utilizing, in
32   whole or in part, the system herein and variations thereof. As would be clear

1   to one skilled in the art, the process steps can be embodied in part as code

2   for a computer program for operation on a conventional programmed digital

3   computer, such as a client and server. The program code can be embodied

4   as a computer program on a computer-readable storage medium or as a

5   computer data signal in a carrier wave transmitted over a network.

6

7   B.   Detailed Description

8   Fig. 1 depicts in one embodiment a schematic diagram of an exemplary

9   expert system. Experts 30 and users 25 interact with Expert System 2. User

10   interaction is via User interface 10. Expert interaction is via an expert

11   interface which is part of Knowledge Base Acquisition Facility 5. The expert

12   knowledge acquired via the Knowledge Base Acquisition Facility 5 is stored in

13   Knowledge Base 25. Upon User 35 interaction with the Expert System 2, an

14   Inference Engine 20, makes inferences from the information gathered from

15   the user in order to interact with Knowledge Base 25 and return advice to the

16   User. An optional Explanation Facility 15 provides the User 35 some

17   explanation of why the particular advice was given.

18   Fig. 2 depicts in one embodiment a schematic system diagram of the

19   invention. The components are Applications Data 265, Collection of

20   Application Objects 255, Products Data 270, and Collection of Product

21   Objects 260 store the knowledge base. Applications Data 265 and Products

22   Data 270 represent the knowledge base stored in long term durable memory

23   such as hard disk drive. Collection of Application Objects 255 and Collection

24   of Product Objects represent the knowledge base in an object-oriented format

25   loaded in computer volatile memory during use of the system.

26   User tool Interface 205 and Dynamic Interface Logic (User tool) 215 are the

27   user interface. Conditions and Ratings Logic 230, Tree Navigation Logic 235,

28   and Product Selection/Filter/Sort Logic 230 are the inference engine. Expert

29   tool Interface 210, Dynamic Interface Logic (Expert tool) 242, Application

30   Modification Logic 245, and Product Modification Logic 250 are the knowledge

1   base acquisition facility. An optional explanation facility (not shown) may be
2   included.

3   Fig. 3 depicts in one embodiment a schematic system diagram of the tree
4   aspect of the invention. A portion of the expert knowledge of the expert
5   system of this invention is acquired via creation of, and stored in, a data tree
6   structure. The tree structure contains the expert knowledge of the application
7   space for a broad class of products; i.e., type of application and operating
8   conditions. Example depicting the possible product applications organized in
9   a tree structure. The tree can be of arbitrary hierarchical shape. Each node
10 in the tree has a question that will be asked of the user (blank for leaf nodes)
11 and an answer (blank for the root node) corresponding to the previous
12 question asked. The graphical interface will lead the user through one path in
13 this tree from the root to a leaf node. Nodes may also have "conditions"
14 and/or "ratings" attached to them. After the user reaches a leaf node in the
15 tree, the conditions and ratings that were attached along the path just
16 traversed will be displayed on the graphical interface.

17 The tree structure may be any now known or later developed data tree
18 structure, including binary trees or multi-trees. The selected structure should
19 be selected for the best fit of the applications and products being included in
20 the expert system. Depicted tree 300 is a multi-tree, i.e., each node 305 may
21 have more than 2 branches. Except for the root node 0, each node has one
22 parent node. Except for the leaf nodes (4, 5), each node 305 has at least one
23 child node. Each node stores information to identify its parent and child
24 nodes, as applicable.

25 Each node, except the root node 0, contains a question for selection of a
26 product application. The range of allowable answers to the question equate
27 to the child nodes of the node in question. When an answer to the node's
28 question is selected, the active node moves to the node associated with the
29 answer. This repeats, thus reaching finer and finer refinements of product
30 application, until a leaf node is reached. By means of the product data
31 structure, discussed below, each leaf node is effectively associated with one

1 or more products that are suitable for the product application represented via

2 the leaf node.

3 All nodes 305 may store information representing one or more condition

4 questions 310 representing the conditions under which the finally selected

5 product(s) is intended to be used. As the user selects a path from the root

6 node 0 to a leaf node (4, 5), the condition questions 310 stored in each node

7 along that path are collected for display to the user and use by the expert

8 system in selecting a product. Additionally, each node may store one or more

9 rating questions 315 which are also collected for later display to the user and

10 use by the expert system in scoring and ranking a product.

11 Fig. 4 depicts in one embodiment an exemplary XML file implementation of

12 the tree structure, i.e., the application tree structure, aspect of the invention.

13 Fig. 5 depicts in one embodiment an exemplary XML file implementation of

14 the product data and its association with the application tree data. The

15 application expert knowledge and product expert knowledge are maintained

16 separately such that they may be edited and managed independently. The

17 application knowledge is entirely independent of the product knowledge. The

18 product knowledge references data in the application knowledge; i.e., each

19 product references suitable applications, valid operating conditions, and

20 expert determined rating scores. Many other data structure implementations

21 of each are possible as known in the art, such as objects, abstract data

22 structures, multi-dimensional arrays, linked lists, and various relational

23 database implementations.

24 Fig. 6 depicts in one embodiment a schematic process flow diagram for the

25 expert-interface aspect of the invention. After Begin step 603 an expert may

26 chose at Edit Expert Knowledge Base choice step 606 to edit the applications

27 or products aspects of the expert knowledge base. If applications is chosen

28 the experts moves to the Display Application Editor step 609. The expert may

29 select to add a new application or edit an existing one and is passed

30 accordingly to the Add Application to application tree step 612 or the Select

31 existing application in tree step 615.

If edit an existing application is selected, the expert then selects from Create new Condition step 618 and Create new Rating step 621. For either, the expert then enters the Associate condition/rating with the tree node step 624. Lastly, the expert enters the Save Data step 627.

If the expert chooses to edit the products, he/she is passed to the Display Product Editor step 630. The expert then chooses from the Create a new Product step 633, Assign product to applications step 636, Select valid conditions step 639, and Assign performance ratings step 642. Lastly, the expert enters the Save Data step 645, and ends 648.

Fig. 7 depicts in one embodiment a schematic process flow diagram for the user-interface aspect of the invention.
After Begin 703, the user enters Answer application question (navigate the tree) step 706. After each answer question step, the system tests if the user is at a leaf node via the Application fully specified (tree leaf node) choice step 709. If not, user is returned to the answer application step 706. If at a leaf node, the system Display relevant conditions and ratings (also referred to as product usability suitability indicators) at step 712. User enters the Select Condition answer step 715, then the Specify rating preference step 718, and optionally the Change an application answer step 721. According the user's selections in the previous steps, the system performs the Filter Products step 724, Score Products step 727, and the Update Product display step 731. At any time, a user may change an application answer, change or add a condition choice, or change a rating. The applicable products list will then be immediately updated and rescored providing instant feedback to the user. A user optionally may Review report and web links at step 734, and then ends 737.

Fig. 8-11 depict in one embodiment exemplary screen shots of the expert-interface aspect of the invention. This aspect of the Expert Interface 801 has products list 810, add grease tool 860, and applications tree structure 820. From this screen an expert enters expert knowledge, e.g., by adding a new product via tool 860 and selects applications via check boxes in the

1 application tree 820. In Fig. 9, the expert then may add use conditions

2 associated with applications for the product via selection boxes 830. Then, in

3 Fig. 10, the expert may add ratings expert knowledge via text boxes in tool

4 840. These, e.g., are the expert's opinion of suitability for the indicated use

5 on a scale of 1-10 with 10 being very suitable. Fig. 11 depicts application tree

6 870, now on the left side of the window and in a different form than in Fig. 8.

7 Here, in text boxes 850, the expert may edit the questions and answers

8 associated with each application, which is effectively modifying the structure

9 of the applications tree.

10 Fig. 12-21 depict in one embodiment exemplary screen shots of the user-

11 interface aspect of the invention. Each Figure shows in succession the

12 progress made as a user selects a path through the tree via text list selection

13 boxes110, 112, 114, 116, 118, then selects conditions via text list boxes120,

14 and rates priorities via product usability suitability indicators via slide selectors

15 130. In selecting a path through the tree, as the user answers a question

16 regarding the intended application a new interactive user interface element,

17 e.g., drop-down box, radio buttons, or other suitable graphic user interface

18 component allowing selecting items from a list, depicting the corresponding

19 child. A listing of suitable greases 150 is displayed based on selections made

20 by the user. The list may change after each user selection if according to the

21 expert knowledge base the suitable products change. The total score

22 resulting from the user's selection of product usability suitability indicators is

23 displayed 148 next to product names in list 150. Any suitable scoring

24 algorithm may be used. One preferred algorithm is to multiply the expert's

25 suitability rating by the user's suitability rating for each use and then add the

26 sum of those products to obtain a final score. Fig. 21 shows how different

27 selections can result in a much wider range of final scores.

28 C.   Other Implementation Details

29

30   1.   Terms

31

1 The detailed description contained herein is represented partly in terms of
2 processes and symbolic representations of operations by a conventional
3 computer and/or wired or wireless network. The processes and operations
4 performed by the computer include the manipulation of signals by a processor
5 and the maintenance of these signals within data packets and data structures
6 resident in one or more media within memory storage devices. Generally, a
7 "data structure" is an organizational scheme applied to data or an object so
8 that specific operations can be performed upon that data or modules of data
9 so that specific relationships are established between organized parts of the
10 data structure.
11
12 A "data packet" is type of data structure having one or more related fields,
13 which are collectively defined as a unit of information transmitted from one
14 device or program module to another. Thus, the symbolic representations of
15 operations are the means used by those skilled in the art of computer
16 programming and computer construction to most effectively convey teachings
17 and discoveries to others skilled in the art.
18
19 For the purposes of this discussion, a process is generally conceived to be a
20 sequence of computer-executed steps leading to a desired result. These
21 steps generally require physical manipulations of physical quantities. Usually,
22 though not necessarily, these quantities take the form of electrical, magnetic,
23 or optical signals capable of being stored, transferred, combined, compared,
24 or otherwise manipulated. It is conventional for those skilled in the art to refer
25 to representations of these signals as bits, bytes, words, information, data,
26 packets, nodes, numbers, points, entries, objects, images, files or the like. It
27 should be kept in mind, however, that these and similar terms are associated
28 with appropriate physical quantities for computer operations, and that these
29 terms are merely conventional labels applied to physical quantities that exist
30 within and during operation of the computer.
31
32 It should be understood that manipulations within the computer are often
33 referred to in terms such as issuing, sending, altering, adding, disabling,

1 determining, comparing, reporting, and the like, which are often associated
2 with manual operations performed by a human operator. The operations
3 described herein are machine operations performed in conjunction with
4 various inputs provided by a human operator or user that interacts with the
5 computer.
6
7   2.   Hardware
8
9 It should be understood that the programs, processes, methods, etc.
10 described herein are not related or limited to any particular computer or
11 apparatus, nor are they related or limited to any particular communication
12 architecture, other than as described. Rather, various types of general
13 purpose machines, sensors, transmitters, receivers, transceivers, and network
14 physical layers may be used with any program modules and any other
15 aspects of the invention constructed in accordance with the teachings
16 described herein. Similarly, it may prove advantageous to construct a
17 specialized apparatus to perform the method steps described herein by way
18 of dedicated computer systems in a specific network architecture with hard-
19 wired logic or programs stored in nonvolatile memory, such as read-only
20 memory.
21
22   3.   Program
23
24 In the preferred embodiment where any steps of the present invention are
25 embodied in machine-executable instructions, the instructions can be used to
26 cause a general-purpose or special-purpose processor which is programmed
27 with the instructions to perform the steps of the present invention.
28 Alternatively, the steps of the present invention might be performed by
29 specific hardware components that contain hardwired logic for performing the
30 steps, or by any combination of programmed computer components and
31 custom hardware components.
32

1   The foregoing system may be conveniently implemented in a program or
2   program module(s) that is based upon the diagrams and descriptions in this
3   specification. No particular programming language has been required for
4   carrying out the various procedures described above because it is considered
5   that the operations, steps, and procedures described above and illustrated in
6   the accompanying drawings are sufficiently disclosed to permit one of
7   ordinary skill in the art to practice the present invention.
8   Moreover, there are many computers, computer languages, and operating
9   systems which may be used in practicing the present invention and therefore
10 no detailed computer program could be provided which would be applicable to
11 all of these many different systems. Each user of a particular computer will be
12 aware of the language and tools which are most useful for that user's needs
13 and purposes.
14
15 The invention thus can be implemented by programmers of ordinary skill in
16 the art without undue experimentation after understanding the description
17 herein.
18
19   4.   Product
20
21 The present invention is composed of hardware and computer program
22 products which may include a machine-readable medium having stored
23 thereon instructions which may be used to program a computer (or other
24 electronic devices) to perform a process according to the present invention.
25 The machine-readable medium may include, but is not limited to, floppy
26 diskettes, optical disks, CD-ROMs, and magneto-optical disks, ROMs, RAMs,
27 EPROMs, EEPROMs, magnet or optical cards, or other type of
28 media/machine-readable medium suitable for storing electronic instructions.
29 Moreover, the software portion of the present invention may also be
30 downloaded as a computer program product, wherein the program may be
31 transferred from a remote computer (e.g., a server) to a requesting computer
32 (e.g., a client) by way of data signals embodied in a carrier wave or other

1 propagation medium via a communication link (e.g., a modem or network

2 connection).

3

4   5.   <u>Components</u>

5

6 The major components (also interchangeably called aspects, subsystems,

7 modules, functions, services) of the system and method of the invention, and

8 examples of advantages they provide, are described herein with reference to

9 the figures. For figures including process/means blocks, each block,

10 separately or in combination, is alternatively computer implemented, computer

11 assisted, and/or human implemented. Computer implementation optionally

12 includes one or more conventional general purpose computers having a

13 processor, memory, storage, input devices, output devices and/or

14 conventional networking devices, protocols, and/or conventional client-server

15 hardware and software. Where any block or combination of blocks is

16 computer implemented, it is done optionally by conventional means, whereby

17 one skilled in the art of computer implementation could utilize conventional

18 algorithms, components, and devices to implement the requirements and

19 design of the invention provided herein. However, the invention also includes

20 any new, unconventional implementation means.

21

22   6.   <u>Web Design</u>

23

24 Any web site aspects/implementations of the system include conventional

25 web site development considerations known to experienced web site

26 developers. Such considerations include content, content clearing,

27 presentation of content, architecture, database linking, external web site

28 linking, number of pages, overall size and storage requirements,

29 maintainability, access speed, use of graphics, choice of metatags to facilitate

30 hits, privacy considerations, and disclaimers.

31

1   ## 7.   <u>Other Implementations</u>

2

3   Other embodiments of the present invention and its individual components will

4   become readily apparent to those skilled in the art from the foregoing detailed

5   description. As will be realized, the invention is capable of other and different

6   embodiments, and its several details are capable of modifications in various

7   obvious respects, all without departing from the spirit and the scope of the

8   present invention. Accordingly, the drawings and detailed description are to

9   be regarded as illustrative in nature and not as restrictive. It is therefore not

10   intended that the invention be limited except as indicated by the appended

11   claims.